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ROLAND V. NORRIS, D. Sc., F.I.C.,
Director, Tea Research Institute.

THE TEA RESEARCH INSTITUTE,
St. Coombs, Talawakelle.

H. W. CAVE & CO., COLOMBO.

The Tea Research Institute of Ceylon.

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Superintendent, St. Coombs Estate ... J. A. Rogers

NOTE.

The Laboratories of the Institute are situated at St. Coombs Estate, Talawakelle, and letters and enquiries should be addressed to the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle. Telegraphic Address:—Research, Talawakelle; Telephone, Talawakelle 44 (Private Exchange). It is particularly requested that letters should not be addressed to officers by name.

FOOD PRODUCTION ON ESTATES

ROLAND V. NORRIS

As readers are already aware, under the terms of the Food Production Order (Estates) all estates over 35 acres in extent are now required to assist in the production of food by placing under cultivation with food crops an area of land proportionate to the cultivated area of the estate. By cultivated area is meant the area under the permanent crop. In this connection it is understood that recently planted or cleared areas will be treated as land not under permanent cultivation. The proportion to be cultivated depends on the nature of the land to be utilised. Thus in the case of tea estates if the food crop is grown interplanted with the tea the proportion is 24 per cent, which is reduced to 12 per cent. if land outside the tea and wholly planted up with food crops is utilised. Land which has been handed over by Estate Proprietors for cultivation by villagers may be regarded as forming part of the prescribed percentage provided that the rental charged does not exceed 10 cents per acre per annum and that the area is planted up with the crops specified in paragraph 2 of the Order. Similarly labourers' gardens form part of the required area if they likewise comply with the latter conditions.

As an alternative estates may combine to form syndicates to acquire land in other more suitable areas, *e.g.*, under several of the new irrigation schemes, for food production purposes. In this case the estate must contribute to the syndicate a sum not less than Rs. 10 per planted area of the estate and the syndicate must be approved by the Minister. A combination of the above methods may of course be adopted. In such a case the sum to be contributed to the syndicate would be calculated as shown below :—

(a) Cultivated area of estate (say) = 1,000 acres tea.

(b) Area cultivable in foodstuffs (if grown out of the tea) = 120 acres.

(c) If the estate cultivates in foodstuffs 70 acres, the balance cultivable = 50 acres.

(d) The 50 acres is in respect of $50 \times \frac{100}{12} = 416.66$ acres of cultivated land.

(e) The sum to be contributed by the estate to the syndicate would therefore be 416.66 × 10 = Rs. 4,166.60.

In calculating the area to be cultivated allowances will also be granted to estates producing fruit or maintaining cattle, poultry, pigs or other livestock contributing to the production of food. At the moment the extent of the allowance* to be made for such stock has not been finally determined and it is probable a small panel will be set up to adjudicate on such claims. Any application for an allowance under this head should be made at an early date to the Land Commissioner.

Paragraph 2 of the Order gives a list of the foodstuffs which are approved under the Order but other varieties may be added to the list by the Minister and it is likely such additions will in fact be made. The most notable omission from the list is green vegetables and many enquiries on this point have been received. The matter has

*Allowances for stock have since been fixed.—Ed.

already been under consideration and it is likely that estates in areas which offer special difficulties in regard to other form of food crops will be permitted to cultivate vegetables to the extent of 25 per cent of the prescribed area.

Under Paragraph 4 of the Order the Minister or any officer acting under his instructions may specify the description of foodstuffs which must be cultivated by any particular estate. It is unlikely, however, that action will be taken under this section unless experience shows that an excess of any one crop is being produced to the detriment of other varieties.

Considerable doubts have been expressed in many quarters as to the feasibility of producing food crops by interplanting these with our permanent crops such as tea, rubber and coconut. Everyone however will recognise the urgent necessity, having regard to the general food position of the Island and the possibility of further restriction of imports of foodstuffs, of increasing by every means possible the amount of food produced in Ceylon. The need for such action is fully appreciated by Proprietors and Agency Firms and it may be taken for granted that Superintendents will co-operate in the fullest possible manner. While the economic aspect must temporarily receive less consideration than would be the case in normal times, it is nevertheless true that what is required is *food* and not merely unproductive cultivation of large areas of land. From this point of view it can hardly be disputed that the cultivation of areas outside estates under suitable conditions of climate and fertility and with facilities for irrigation is likely to produce far greater practical results than the interplanting of possibly larger areas on estates often in districts which, due either to elevation or excessive rainfall, are really unsuitable for many varieties of crops, particularly grain crops. The possibility of forming syndicates for the development of land in suitable areas under irrigation schemes therefore demands the closest and most careful examination. It is not impossible that Government may offer some financial inducement to encourage estates in such schemes, possibly by compensating them to some extent when the areas are ultimately restored to Government for the expenditure incurred in development The chief practical difficulty at the moment however seems to be the question of labour. Estates generally have no surplus of labour at the present time and there are in any case difficulties in transferring labour from up-country to undeveloped areas with inadequate facilities for housing and unsatisfactory health conditions.

We may now pass on to consider the general organisation of food production work on estates. A Central Co-ordinating Committee has been set up under the Chairmanship of the Deputy Director of Agriculture and including the Food Production Officer (Estates) and the Directors of the three Research Institutes. The functions of this Committee, which is advisory to the Director of Agriculture, is to collect as rapidly as possible all possible information in regard to the varieties of foodstuffs which can possibly be grown in different areas, the methods and times of planting and the type of cultivation required and to disseminate such information to estates by the issue of frequent circulars. The Committee will likewise investigate and advise in regard to the storage and utilisation of the crops produced and the damage which may be caused by pests and diseases. The Committee will also act in an advisory capacity in regard to possible amendments which may be required from time to time

to the Food Production Order as experience on food production is accumulated.

To assist the Committee in acquiring the necessary information all District Planters' Associations have been asked to form local food production committees. It is suggested these should not necessarily be confined to planters but should, if available, include others who may have special local knowledge or experience in regard to food production. Such committees should be in a position to collect information rapidly in regard to the work in their own areas, to bring to notice any special difficulties that may arise, to suggest additional food crops considered suitable for trial and to indicate particular areas which might be adopted as special observation areas from which reliable data can be obtained as to what can be achieved and what may be impossible in districts under different climatic conditions

To assist such committees it is proposed that technical officers from the Department of Agriculture or the Research Institutes should be attached to them to act as liaison officers and to make such advisory visits to districts as may be found necessary. To make this possible the Board of the Tea Research Institute has decided that with the exception of the permanent field experiments, work on food production is to take precedence over other problems and as much time as possible of the staff will be devoted to food production. Trials of different crops will of course be made on St. Coombs Estate.

To assist further in obtaining the required information from estates in regard to the success or failure of their efforts to produce food it will probably be necessary to call for quarterly returns from estates. These reports will be in a simple form involving as little trouble as possible to Superintendents in filling them up. Data however are required concerning the acreages of the different crops planted, their manner of growth, maturing period and yield under different climatic conditions. Such information will assist materially in organising inspectional and advisory work. In this connection it should be mentioned that in order to reduce mileage and time in visiting districts, such districts will be divided amongst the available staff of the Department of Agriculture and the Research Institutes on a geographical basis and in certain areas therefore tea estates, in regard to food production, will come under the general supervision of officers other than those of the Tea Research Institute and *vice versa.*

To pass to more technical matters, an advisory circular drawn up by the Department of Agriculture in consultation with the Staff of the Tea Research Institute, and dealing with the growth of crops in pruned tea, has already been issued to all tea estates. [Leaflet No. 192 (Food Production Leaflet No. 13) of the Department of Agriculture.] It will be recognised that the initial difficulty to be faced is that little or no experience is available in regard to the growing of food crops at the higher elevations and especially when interplanted with tea. The recommendations in the above leaflet have necessarily therefore had to be based almost entirely on general principles and it is for this reason that the importance of receiving as early as possible information from estates as to the results achieved has already been stressed. This will enable the recommendations made to be amended as found necessary and additional advice to be given. Leaflet No. 192 does not deal with root crops in regard to which there was at first some doubt as to the feasibility of growing them in tea. Experimental evidence from the cultivation experiments at St.

Coombs indicates however that it is unlikely that such crops will have an unduly detrimental effect on the tea and the recommendation is that they should therefore be tried. In the wetter areas it is indeed likely that in the South West Monsoon period they may prove to be the crop of most importance and this applies particularly to sweet potatoes and to a less extent to manioc. A leaflet dealing with these crops will shortly be issued; meantime some details in regard to their production will be found in Food Production Leaflets Nos. 11 and 12 of the Department of Agriculture.

Leaflet No. 192 has already been issued to all estates and it is unnecessary therefore to go over the same ground again. Attention however is drawn to the time factor imposed by the short interval, particularly in the low-country, between the time of pruning and the period when the tea on recovery may begin to interfere with the food crop. Careful planning in regard to the arrangement of pruning and cultivation programmes is therefore necessitated as also attention at lower elevations to the type of pruning. Recommendations in regard to these points are made in the leaflet. The importance of manuring the food crop and the methods of carrying this out are also indicated. In this connection it seems likely difficulties will be encountered owing to restrictions on transport facilities delaying the delivery of fertilisers to estates. In the case of cereal crops especially, this delay may have a detrimental effect as such crops take up a large proportion of their nitrogen in the early stages of growth. The Co-ordinating Committee has taken up the question of fertiliser supplies with the Authorities concerned but in face of military demands on the railway, deliveries must necessarily be somewhat uncertain.

Every effort should therefore be made to make use of all available cattle manure and waste materials which should when necessary be composted. This will apply likewise to the residues from the crops produced.

Leaflet No. 192 deals with foodcrops in pruned tea. In developing uncultivated land for food production it is necessary to stress the urgent necessity for opening such land on sound agricultural principles with special attention to the question of soil conservation. If this be done, the fertility of such areas will be maintained and they may well prove suitable at a later date for planting in tea. In connection with the conservation of soil fertility it will be essential to see that a proper crop rotation is adopted. Attempts to raise the same crop on any one area in successive cropping seasons will inevitably result not only in a failure to secure reasonable yields but also in a rapid deterioration of the area so treated.

A word must be said in regard to the storage of the crops which it is hoped will be produced. Many of these are subject to rapid deterioration on storage and this question is already being dealt with by the Co-ordinating Committee. This applies also to the question of the best utilisation of such crops as manioc and sweet potato. It is hoped that information on such points will be available at a relatively early date and all information obtained will of course be passed on to estates in further leaflets. The question of exchange of produce between different areas is also being examined.

Some difficulty, chiefly in regard to transport, has been experienced in obtaining the necessary supply of seed for estate use. Orders for these were placed at an early date by the Department of Agriculture and

supplies are now coming forward, and it is hoped there will be no undue delay in meeting estate requirements. Enquiries on this question should be directed to the Director of Agriculture (Seed Distribution), Peradeniya.

In conclusion, it must again be stressed that the repetition of mistakes can be avoided and more rapid progress achieved only by a pooling of all available information. It is hoped therefore that Superintendents will co-operate in this direction and make generally available either through their District Food Committees or their Research Institute, all possible information they may gain in their food production efforts.

STUDIES ON THE FIRING OF TEA.—III

J. LAMB

In previous articles [1] the results of experiments designed to find the best firing temperature have been described. Briefly, it was proved that 190°F gave the best all round teas, whilst firing at lower temperatures (160°F), although giving superior quality, pungency and flavour, did not ensure keeping qualities. These previous articles have described the technique of the experiments and it is only necessary to recapitulate in order to emphasise the fact that each conclusion is based on the results of at least 21 experiments carried out at all seasons of the year and involving either 42 or 63 days' manufacture according to whether two or three days' work is bulked for sampling. Each sample is drawn from the bulk of tea fired over two or three-day periods. The total number of samples dealt with in the course of obtaining the results described in this article was 654. All samples were tasted by a team of tasters, the personnel of which did not change to any appreciable extent so that differences due to personal factors were minimised. The samples were sent under a serial number so that the "team" were not even aware that they were from firing experiments.

The method of reporting has several times been described in *The Tea Quarterly.* Appearance, colour, strength, quality and pungency or flavour, if present, have all been marked separately and each sample valued on the market ruling at the time of tasting. A simple arithmetic average has been drawn up of each team result and all fractions disregarded. For instance, suppose the average mark for the strength of a sample was 10.5 compared to the 10 marks given to every standard then 10.5 would be regarded as 10 and the conclusion that there was no difference in the strength would be drawn from the result. If, on the other hand, the average was 11.2, it would be accepted that the team had found a real difference between the teas. Similarly in the valuations all fractions of less than 0.6 cent were regarded as having no significance.

These are very rigid tests and bring out only marked differences of practical importance.

Most of the teas were tasted in pairs, one being the standard, and never were more than three teas compared to the same standard. This makes for accurate tasting as a taster cannot be expected to remember all the features of each tea when working down a long row of cups with only one standard.

When describing the results of the experiments on the effect of firing temperature, the averages of the taster's analyses for each separate season were all tabulated. Since in the present results all the differences were in either strength or quality, and most of the seasonal differences were not significant, it is proposed greatly to simplify the tabulation of results and to give only the significant differences in the valuation for each complete series.

through the drier. In these experiments therefore the temperature was fixed at 190°F. and the load and air flow so adjusted that a moisture content of 3 per cent was obtained in about the normal time of 20 minutes. Low or high moisture contents were obtained by variation of firing time to give the figures required.

It is quite clear from Table I that 3-4 per cent is the moisture content associated with the best teas. Curiously enough firing to very low moisture contents apparently impairs keeping quality. This has been known in practice for some years but the usual explanation of "case hardening" does not fit the facts in this case. A condition to which the term "case hardening" may be an apt description may arise when teas are dried rapidly at high temperature, but a tea dried at 190°F. under

TABLE I

Comparison of valuations of teas fired to different moisture contents
(Based an 66 days' manufacture)

Moisture % * (On discharge from drier)	Comparative valuations based on Standard (Differences in cents.)	
	Fresh teas	Teas stored for two months
4 to 6	0	—1
3	Standard	
2	—1	—2
1 to 2	—2	—2

* Moisture contents were about 1 per cent higher when tasted. They absorbed moisture during the grading process. The very dry teas sometimes picked up more than 1 per cent during grading.

I. FIRING TO DIFFERENT MOISTURE CONTENTS AT 190°F.

In commercial drying at any fixed inlet temperature the moisture content depends mainly on the time taken to pass the tea

standard conditions of air flow and load dries at a fixed rate and the low moisture content is merely a result of length of drying. At the present moment there is no explanation which fits all the facts.

The moisture contents given in the table are the moisture contents at the moment of discharge from the drier. Teas fired to 3 per cent moisture content will pick up about 1 per cent during grading and storage (if storage conditions are good) and should be despatched at about 4.0 to 4.5 per cent.

The problem of what to do with teas which absorb more moisture than this now arises.

2. FINAL FIRING TEAS ORIGINALLY FIRED TO 3% MOISTURE CONTENT AT 190°F.

As the object of final firing is only to drive off a little excess moisture, neither high temperatures nor long periods of firing are necessary or desirable. Previous experiments have shown quite clearly that temperatures above 160°F. and times above 20 minutes are both detrimental to quality to some extent although the loss at 190°F. is small. On the other hand the moisture in tea when the material is comparatively dry at, say, 6 per cent is held tenaciously and is not readily lost to moderately hot air in short periods of time. Accordingly final firing was carried out at 160°F. for 15 minutes, both these figures representing minima for effective treatment.

The conclusion was therefore that final firing for 15 minutes at 160°F. is quite innocuous. The figures bracketed in the table indicate a slight deleterious effect immediately after final firing a tea containing 4 per cent moisture but this effect disappears after 2 months' storage and the tea is then slightly better for the final firing. For all practical purposes we can say that final firing, when unnecessary from the point of view of moisture content, does little harm or good. Normally when it is possible to determine moisture contents, unnecessary final firing would be avoided on account of additional cost, especially as no benefit is derived from it.

The next question is does a small rise in moisture content do any harm ? Table III displays figures which answer this question.

TABLE II

(Based on 44 days' manufacture)

Original firing to 3% at 190° F

Final firing 15 minutes at 160° F

Sample	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for 2 months
Original tea at 4%*	Standard	
Original tea after final firing	0 (−0.4)**	0 (+0.5)**

* The moisture content rose to 4 per cent after grading.

** The actual differences were too small to be regarded as significant.

Gain in moisture is shown to cause definite deterioration amounting to 2 cents. The fresh teas normally reached the tasters on an average of about two weeks after manufacture and even in this short time there was marked deterioration.

When teas gain moisture and start to deteriorate final firing can only be expected to arrest deterioration.

The loss of two cents in the value of fresh teas shown in Table IV agrees well with the previous table but equality with the standard after two months' storage is not so easy to understand.

Further to study the effects of final firing it is necessary to make a comparison of the teas containing 6-7 per cent moisture before and after final firing. Table V affords such a comparison.

TABLE III

(Based on 44 days' manufacture)

Sample	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for 2 months
Original graded tea containing 4% moisture	Standard	
Original tea allowed to absorb moisture up to 6-7%	—2	—2*

* This value was increasing but had not reached a significant. —3.0 in two months.

TABLE IV

(Based on 44 days' manufacture)

Sample	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for 2 months
1. Tea fired to 3% moisture at 190° F. and containing 4% after grading	Standard	
2. Above samples allowed to gain 6-7% moisture during storage in bins before packing. Final fired at 160°F. for 15 minutes before packing	—2	0

These results confirm previous findings and reveal that in spite of the increased moisture present no apparent harm has resulted from final firing. The effectiveness of the treatment is gauged from the fact that after two months' storage the final fired teas were valued two cents higher than the standard which had not been final fired.

These figures do not however offer any explanation of the curious result shown in Table IV where final fired teas reach equality with the standard 4 per cent moisture content tea after two months' storage. For further information on this point it is necessary to look into more detail at the tasters' opinions from season to season and it is possibly a case where some seasonal effect influences the effects of final firing. Table VI displays the average differences in the comparison with the standard worked out from each season.

TABLE V

(Based on 44 days' manufacture)

Sample	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for 2 months
1. Teas containing 6-7% moisture (fired at 190°F. to 3%)	Standard	
2. Above after final firing for 15 minutes at 160°F.	0	+2

TABLE VI

	Average difference, compared to standards, for each season (Cents)			
	Fresh teas		Teas stored for two months	
	(a) 6-7% moisture (originally 4%)	(a) Final fired to original moisture content	(a) 6-7% moisture (originally 4%)	(a) Final fired to original moisture content
Dry weather	0	+1	—1	+1
Inter Monsoon (April)	—1	+2	—1	+3
S. W. Monsoon	—1	—3	—3	—1
Inter Monsoon (Aug.)	—4*	—2	—3	0
N. E. Monsoon	—4*	—6*	—4*	—5
Average shown in Tables III & IV	—2.0	—1.6 *i.e.*, —2.0	—2.4 *i.e.*, —2 0	—0.4 *i.e.*, 0

* Market high but showing discrimination; differences therefore large.

The columns headed 6-7 per cent are the parallel details for Table III. Although at all seasons rise in moisture causes deterioration there are indications that in certain circumstances rise of moisture followed by final firing may improve teas. This process may be what is commonly known as "maturing." Under drier conditions in the dry weather, and the two inter-monsoon periods, (to a lesser extent in the August period between the South-West and North-East), this improvement following final firing is most marked. It is possible that underfermented particles of leaf under the influence of moisture may slowly oxidise and improve provided that the process is arrested by final firing before it leads to softness. On the other hand the deterioration which is so marked in the wet weather may be due to bacterial activity as observed by Benton in N. India.

The process of maturation is a very difficult one to investigate and has so far resisted all efforts to discover the exact conditions under which it takes place. The results obtained in these experiments will however afford new lines of investigation. Until the process is better understood it is obviously best to guard against rise of moisture during storage as far as possible in commercial manufacture.

3. THE TREATMENT AND HANDLING OF TEA AFTER FIRING

Having regard to the importance of moisture content and the prevention of excessive gain of moisture during operations subsequent to firing, the handling of tea after its discharge from the drier is a question of considerable importance. Fired tea should obviously be packed into boxes and denied access to air as soon as possible. Freshly fired tea gains moisture rapidly even in the comparatively dry atmosphere of the firing room and the sooner it is packed into boxes the less the gain in moisture will be. However, the question arises as to whether it is desirable to pack tea while it is hot since owing to its nature it is obviously likely to retain its heat for considerable periods. This question was accordingly investigated by further experiments. Four series of samples were examined.

(i). Samples fresh from the drier which had moisture contents averaging 2.6 per cent and temperatures of 160-165°F. as measured by a sensitive thermometer inserted into a bulk of the hot leaf. The firing temperature was 190°F.

(ii). Samples of leaf as in Section I which were spread out on a wooden table to cool off until they were just warm to the hand. The moisture contents then averaged 3.3 per cent and temperatures 85-90°F.

(iii). Samples as in Section I packed straight into boxes, carried and stored for grading on the following day. The moisture contents then averaged 2.7 per cent and the temperatures 100-115°F.

(iv). Samples as in Section II packed into boxes, covered and stored overnight. The moisture content was then 3.6 and temperatures 75-80°F.

The leaf packed hot retained its heat and showed very little rise in moisture content but the effect of such conditions on quality was of course open to grave doubts. On the other hand the cooled leaf already showed a gain of 1 per cent moisture before grading, as indicated by Section IV. The

tasters' opinions were very decisive and it was only considered necessary to repeat the experiment nine times.

The teas stored in the hot condition were sometimes reported as "bakey." Strength and quality in the case of the teas stored for two months were both marked down significantly.

TABLE VII

Sample	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for two months
1. Teas cooled before storing	Standard	
2. Teas stored in hot condition	—2	—3

In spite of gains in moisture therefore teas should be cooled before packing into boxes. The gain may be reduced by cooling in the dry atmosphere of the firing room and to prevent further gain during grading a hygrometric difference of 10°F. should be maintained in the grading room while work is in progress.

DISCUSSION OF RESULTS

The above results may be said to complete the experiments on the most practical considerations of firing tea in Ceylon. They have not revealed the necessity for any change in the technique of firing and, indeed, it would have been surprising if after about a century of experience in hundreds of commercial factories, a comparatively few experiments at the Tea Research Institute revealed some fundamental improvement in what is undeniably a comparatively simple industrial operation. In fact. it is doubtful whether firing by hot air will ever be superseded and as the modern types of tea drier are efficient, simple and by most standards economical, also more especially as they represent a considerable capital sum in installation costs, any radical change in the technique of tea drying is not to be expected in the very near future. Therefore, tea drying as it is, and not tea drying as it might be if different types of machines were available, is of primary interest to the worker in applied science who is concerned with tea manufacture in Ceylon.

It is not to be imagined that since tea drying is a comparatively simple operation that there is not room for error and controversy. The number of possible permutations and combinations of temperatures, times, moisture contents and so on is very large and only systematic investigation can hope to establish the best set of conditions. Superimpose on these difficulties the questions of various possible ranges of temperature and time for final firing, and the range of moisture content for final packing. It then becomes even more obvious that to establish optimum firing conditions is a task of some magnitude which can only hope to succeed under conditions controlled by scientific methods. Such conditions have been established and it is now possible to say what are the optimum conditions for

firing Ceylon tea in a single operation. Temperature, time, moisture content and so on are no longer matters of controversy, fads and fancies as they have tended to be in the past. Firing at high temperatures and firing at low temperatures have alternately, in cycles of years, become fashionable and the apparent reason for some transient success. The novelty then faded out of general interest only to be rediscovered again some time later. Firing at exceptionally high or low temperature inevitably causes changes in the time of firing and other conditions, so it is never possible to say that the innovation is the primary cause of any apparent success.

One particular character in the green leaf may be accentuated by a change of firing method and market demands for this particular character may further contribute to transient improvement. More often than not, keeping quality suffers when firing conditions are extreme in any respect and during the course of years a set of what have become to be regarded as "normal" conditions has been evolved as a result of continuous trial and error.

SUMMARY OF RECOMMENDATIONS ON FIRING

The following are the optimum conditions for firing tea in a single operation in a standard type of tea drier in Ceylon.

1. Temperature 185-190°F.
2. Moisture content of discharged tea 3 per cent approximately (say 2.5 to 3.5).
3. Time through drier 20 minutes approximately (say 19 to 21 minutes).
4. As several times explained in *The Tea Quarterly*, one of the best indices of correct firing conditions is an exhaust temperature of 125-130°F. The range of exhaust temperature varies in different types of driers and also with the amount of moisture in the fermented leaf but the exhaust temperature of an endless chain type of drier working at 190°F. and turning out teas with 3 per cent moisture in 20 minutes should not vary outside this range. A tilting tray type of drier working under similar contions shows a depression of temperature every time the trays tilt which will be roughly every 3½ minutes on a 21-minute pulley. In this case the temperature falls to about 115°F. for a few seconds and rises to 120 within a minute. At the end of the cycle there is a rapid rise to 130°F. or slightly higher.
5. Moisture content after grading and storage prior to packing not above 4.5 per cent. Packed teas should not contain moisture exceeding 5 per cent.
6. Teas likely to exceed 5 per cent moisture content on packing should be final fired for 15 minutes at 160°F.
7. Teas hot from the drier should be cooled to a temperature just warm to the hand before storage or packing in boxes.

REFERENCES

1. *Tea Quarterly*, 1939, XII, p. 171.
Ibid 1940, XIII, p. 156.

STUDIES ON THE FIRING OF TEA.—IV

J. LAMB

FURTHER EXPERIMENTS WITH TEAS FIRED AT 160°F.

The second article [1] in this series gives the results of firing at different temperatures. It was found that although firing at 160°F. resulted in good quality teas, the quality showed signs of deterioration on no fewer than 18 occasions out of 32 when the low fired teas were stored for two months. Various ways of overcoming this difficulty have been investigated.

1. *Time of Firing.*—Various times of firing ranging from 24 minutes to 42 minutes were compared, the moisture content being reduced to 3 to 4 per cent in each case.

These results shown in Table I although not really significant indicate that the best firing time is between 24 and 33 minutes.

2. *Final Firing.*—The deterioration of teas fired at 160°F. is rapid when the moisture content is allowed to rise to 6-7 per cent. This is shown by the figures in Table II where figures showing the arrestment of deterioration by final firing are also displayed.

A second treatment with hot air however results in loss of quality which is most marked in teas requiring final firing owing to gain in moisture content.

TABLE I

Time of Firing	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for two months
24	Standard	
33	+0.6	—0.2
42	—0.8	—0.5

These points are shown in Table III and indicate failure to bring about improvement of keeping quality without detriment to the teas.

SUMMARY

Attempts to improve the keeping quality of teas fired at 160°F. by varying the time of firing and by final firing for 15 minutes at 160°F. have not proved successful.

REFERENCE

1. *Tea Quarterly*, 1940, XIII, p. 156.

TABLE II

Sample	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for two months
1. Tea stored at 4% moisture	Standard	
2. Above allowed to rise to 6-7% moisture	—2	—2
1. Tea at 6-7%	Standard	
2. 6-7% reduced to 4% moisture by final firing	+1	+1

TABLE III

Sample	Comparative valuations based on Standard (Differences in cents)	
	Fresh teas	Teas stored for two months
1. Teas fired at 160°F. and stored at 4%	Standard	
2. Teas as in 1 final fired at 160°F. for 15 minutes, *i.e.*, practically, a second firing	—1.4	—0.4*
3. Teas as in 1 final fired after moisture content had risen to 6-7% as a result of storage in bins	—1.0	—1.5

* This value is not really significant. Since however the object is to improve keeping quality compared to the tandard anything below +1 indicates failure.

REPORT ON SMALL-HOLDINGS COMPETITION HELD IN THE SOUTHERN PROVINCE, DECEMBER, 1941.

T. EDEN

The competition was held in the Talpe Pattu. The final selection from 26 holdings was made during the period December 12th to 17th. The prize-giving was held at the Kottawa Government School on December 19th. Mr. T. B. Panabokke, First Adigar, and Chairman of the Tea Research Institute, presided. There were also present the Members of the State Council for the Udugama and Galle Constituencies, the President and members of the Village Committee who had identified themselves with the work of the Institute by contributing half the prize money, and the competition judge.

The prevailing feature of work in this neighbourhood is that it is often difficult to arouse enthusiasm in the small-holder. but when once he starts, he does a very thorough piece of work. He can best be persuaded by example rather than precept. The Small-Holdings Officer has made a point of gathering together small-holders from this area and taking them on to prize holdings in the last year's working area which adjoins. This method has invariably been successful. It is of interest that recently prize-winners used their prize-money to visit St. Coombs and see something of the experiments and management upon which our advice to small-holders is based.

The general pattern of the work attempted does not greatly alter from year to year. In most cases the work starts from scratch, and drains, terraces and green manure shade trees are the first matters to receive attention. But it is noticeable in this area that there is a willingness to employ many and varied improvements rather than to be content with just one or two. In marking the holdings I found it necessary to give marks for no less than seventeen points. The prize-winning score-sheets showed markings on an average of twelve of these points.

The most consistent good work was done on drains and boundaries. Nearly everyone had attempted to protect the land from erosion by improved or newly-cut drains, efficient leaders, and storm drains to intercept water from higher land adjoining the holding. In other ways too boundaries had received attention — live hedges of gliricidia were common.

In this competition I saw more persistent attempts to grow bush and ground covers than on any previous visits to small-holdings. Another advance was the high proportion of simple compost-making in progress. The system adopted is one involving three pits so that continuous manufacture is possible Despite the inevitable tendency to do something in a hurry because the judge is coming, (a procedure that neither deceives nor impresses the judge) there were a number of holdings where not only is the principle of continuous composting now appreciated, but also some of the refinements, for example the value of mixed material. An appreciable number of holders were making use of local coconut poonac as a fertilizer.

As I go from holding to holding, from district to district in different years, I am struck by the same trend of events in all circumstances. That trend is towards improving the holding as a piece of cultivable land. A series of drains, well-edged with turf ; a good stand of gliricidia, a well-defined and protected boundary ; terraces and compost pits ; all these have a permanent capital value, and with certain reservations require a major effort, once and once only. The real test comes in th attitude to recurrent works and in improv ing the plant itself. Shade control, continu ous compost manufacture, good pruning an plucking are more difficult to find becaus they require unremitting attention and ar less spectacular. These will come in time Meanwhile the degree of improvemer already achieved is a credit to the instruc tion offered by the officer-in-charge.

MINUTES OF A MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD 18-12-41

Minutes of a Meeting of the Board of the Tea Research Institute of Ceylon held at the Ceylon Chamber of Commerce Room, Colombo, on Thursday, 18th December, 1941, at 2-30 p.m.

Present.—The Chairman, Tea Research Institute of Ceylon (Mr. T. B. Panabokke, Adigar); the Hon'ble the Financial Secretary (Mr. H. J. Huxham); the Director of Agriculture (Mr. E. Rodrigo); the Chairman, Planters' Association of Ceylon (Mr. D. E. Hamilton); the Chairman, Ceylon Estates Proprietary Association (Mr. C. H. Bois); Messrs. R. G. Coombe, J. W. Oldfield, C.M.G., O.B.E., M.C., J. D. Hoare, J. C. Kelly, G. K. Newton, W. H. Gourlay, W. P. H. Dias, Dr. R. V. Norris (Director and Secretary, T.R.I.), and by invitation the Visiting Agent (Mr. H. Tonks) and the Superintendent, St. Coombs (Mr. J. A Rogers).

1. The Notice convening the Meetin was read.

2. The Minutes of the Meeting of th Board held on the 6th November, 1941 were confirmed.

3. MEMBERSHIP OF THE BOARD

The Chairman extended a welcome t Mr. W. P. H. Dias who had been nomi nated to represent the Low-Country Pro ducts Association for three years as from 17th November, 1941.

A cordial vote of thanks was recorded to Mr. S F. H. Perera for his services while a Member of the Board.

4. MINUTES OF THE ESTATE AND EXPERI MENTAL SUB-COMMITTEE HELD 29-11-41

The Minutes of the Meeting of the Estate and Experimental Sub-Committee held on the 29th November, 1941, were recorded.

5. SMALL-HOLDINGS WORK

Reported that Mr. Illankoon's services would no longer be available in 1942 as he would be on whole-time military duty.

The Board approved the arrangements suggested by the Director that Mr. Jayawardene, Field Assistant, St. Coombs, be deputed to act for Mr. Illankoon and a *temporary* appointment be made to fill the vacancy caused by Mr. Schuilling's resignation.

As regards transport arrangements for Mr. Jayawardene, the Board agreed that the cost of providing this should be met by the Institute and that a motor cycle should be purchased if obtainable and provided arrangements for necessary petrol could be obtained. Failing this other means of transport to be considered by the Chairman and Director.

The Chairman said the cost of the above arrangement would amount to about Rs. 4,000 under Research Revenue Account and provision would have to be made under Capital Account for the motor cycle. The Finance Committee were in favour of these additions to the estimates. The Board concurred.

6. FINANCE

(a). The Institute's accounts to 30th November, 1941, were tabled and it was reported that a further sum of Rs. 25,000 had since been placed on fixed deposit against loan charges to be met in 1942.

The accounts were accepted.

(b). Research Estimates, 1942.—The recommendations of the Finance Committee were reported and the Board accepted the draft estimates of Rs. 246,681 under Revenue Account and Rs. 2,800 under Capital Account with the following additions, viz. (i) Provision to be made for additional work on small-holdings, *vide* Item 5 above; (ii) Insurance vote to be increased to provide cover on garages; and (iii) Vote 76, Observatory allowance, to be increased to Rs. 240.

Estate Estimates, 1942.—The recommendations of the Finance Committee were reported and the draft estimates, Rs. 126,433 under Working Account and Rs. 16,775 under Capital Account, were approved subject to the following additions : Vote 17, Insurances, to be increased by Rs. 1,525, *i.e.*, Rs. 1,205 to meet increased cover on Factory and Machinery in view of rise in replacement value, and Rs. 320 to provide for extension of period of indemnity under the Loss of Profit Insurance. With regard to Vote 62, Factory Upkeep, a supplementary vote to be asked for if necessary to cover renewal of factory wiring.

The Board formally approved the allocation of General Charges as to 10 per cent to Capital Account and 90 per cent to Working Account.

(c). General Financial Policy.—The Director reported the recommendations of the Finance Committee, namely :—

(i) Owing to present war conditions it was impossible at the moment to make any reliable estimate of probable receipts.

(ii) In view of the above it was essential to maintain reserves at a figure higher than would normally be necessary.

(iii) Further consideration of the cess and reserves should be postponed until the position became clearer, any available funds meantime being invested in war loans.

The Board accepted these recommendations, also the further recommendation of the Finance Commmittee that depreciation should continue to be credited at the existing rates. It was further noted that the cash reserves were not earmarked against any particular reserves but could be utilised in any way at the discretion of the Board.

The Director said further funds arising from tea sales would shortly be available for investment.

(d) *Food Production on St. Coombs.*—The Director referred to the recent Government notification on the above subject. After discussion in which Mr. Bois reported that further enquiries on the subject were being made by the Ceylon Estates Proprietary Association, it was decided to defer the question until these enquiries were complete. The Board recorded their wish to co-operate in food production.

7. RESEARCH FOR THE LOW-COUNTRY

Reported that the Director had now completed his visits to Low-Country Planters' Associations to discuss the above question. His report would come up for discussion on its technical issues by the Experimental Committee at an early date, and it was considered the matter might then be referred to a Sub-Committee of the Board. The following Committee was appointed for this purpose : the Chairman of the Board, Messrs. G. K. Newton, J. D. Hoare, W. P. H. Dias with the Director and Dr. Gadd.

8. ANY OTHER BUSINESS

(a) Estimates, 1941.—(i) The Board sanctioned the transfer of Rs. 756 from Estate Working Account, Vote 10, Medical, to Estate Capital Account, Vote 70, Maternity Home Equipment. (ii) An additional sum of Rs. 330 was sanctioned under Vote 17, Insurance, to meet increased cost of cover on the factory and machinery.

(b) A cordial vote of thanks was passed to the Ceylon Chamber of Commerce for the use of their rooms for T. R. I. meetings.

The Meeting then concluded with a vote of thanks to the Chair.

ROLAND V. NORRIS,

Secretary.

NOTICES

The Institute's Laboratories and Offices are situated at St. Coombs, Talawakelle, and all applications and enquiries should be addressed to the Director, Tea Research Institute, St. Coombs, Talawakelle.

Specimens and other consignments sent by rail should be forwarded to Talawakelle Station c/o Messrs. M. Y. Hemachandra & Co., Forwarding Agents. *Carriage should be pre-paid.*

Visitors' Days.—The *second* and *last* Wednesdays in each month have been set aside as Visitors' Days at St. Coombs Estate, and also at the T. R. I. Sub-Station, Gonakelle Estate, Passara, when it is hoped anyone interested will visit the Stations.

Visitors at other times are welcomed, but it is requested that an appointment be made if possible.

RULES FOR THE OCCUPATION OF ST. COOMBS GUEST HOUSE

(1). The Guest House is normally intended for the use of persons visiting the Institute and St. Coombs Estate on business. Children can in no circumstances be accommodated.

(2). Permission to occupy a room for the night must be obtained from the Director in writing and, unless sufficient notice be given, accommodation cannot be guaranteed. Two double rooms are available for the use of visitors accompanied by their wives.

(3). All visitors must sign the Visitors' Book on arrival.

(4). A bedroom may not be occupied for more than one night if required by another visitor. This shall not apply to Members of the Board or of Committees meeting at St. Coombs who shall also be entitled to priority in the allocation of accommodation when on official business.

(5). Complaints or suggestions shall be entered in the book provided for the purpose and not made to the Guest House Staff. All payments due for services rendered shall be made in *cash* to the steward-in-charge and a receipt obtained from him on the official form. The scale of approved charges is posted in the building. The steward is forbidden to give credit or to accept cheques.

(6). Liquor is supplied for consumption *in the premises only.*

(7). The Institute accepts no responsibility for cash, jewellery or other valuables of any kind left in the Guest House.

(8). All breakages will be charged for at cost price.

ROLAND V. NORRIS,
Director.

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(5). Complaints or suggestions shall be entered in the book provided for the purpose and not made to the House Staff. All payments due for services rendered shall be made in cash to the steward-in-charge and a receipt obtained from him on the official form. The sale of approved liquors is posted in the building. The steward is forbidden to give credit or to accept cheques.

(6). Liquor is supplied for consumption in the premises only.

(7). The Institute accepts no responsibility for cash, jewellery or other valuables of any kind lost in the Guest House.

(8). All breakages will be charged for at cost price.

BODLEYD V. NORRIS
Director

The Tea Research Institute of Ceylon.

BOARD OF CONTROL

(A) Representing the Planters' Association of Ceylon:—

(1) Mr. R. G. Coombe

(2) Mr. James Forbes (on leave), Mr. G. K. Newton (acting).

(3) Mr. J. D. Hoare

(B) Representing the Ceylon Estates Proprietary Association:—

(4) Major J. W. Oldfield, C.M.G., O.B.E., M.C.

(5) Mr. I. L. Cameron (on leave) Mr. W. H. Gourlay (acting)

(6) Mr. J. C. Kelly

(C) Representing the Low-Country Products' Association:—

(7) Mr. W. P. H. Dias

(D) Representing the Small-Holders:—

(8) Mr. T. B. Panabokke, First Adigar (Chairman)

(E) Ex-Officio Members:—

(9) The Hon. the Financial Secretary

(10) The Director of Agriculture

(11) The Chairman, Planters' Association of Ceylon

(12) The Chairman, Ceylon Estates Proprietary Association

Secretary, Roland V. Norris, D.Sc., St. Coombs, Talawakelle.

CONTENTS.

		Page
(1).	Norris, R. V.—Food Production on Estates ...	1
(2).	Lamb, J.—Studies on the Firing of Tea—Part III	5
(3).	Lamb, J.—Studies on the Firing of Tea—Part IV	13
(4).	Eden, T.—Report on Small-Holdings Competition in the Southern Province ...	15
(5).	—— Minutes of the Meeting of the Board of the Tea Research Institute of Ceylon held on the 18th December, 1941.	16
(6).	—— Notices	18

The publications of the Tea Research Institute will be sent, free of charge, to Superintendents of Ceylon tea estates, over 10 acres in extent, and to Estate Agencies dealing with Ceylon tea, if they register their names and addresses with *the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle.*

Other persons can obtain the publications of the Institute on application to the Director, the subscription being Rupees fifteen per annum for persons resident in Ceylon or India, and £1-5-0 for those resident elsewhere. Single numbers of *The Tea Quarterly* can be obtained for Rs. 2-50 or/4*s*. In the case of Indian cheques four annas should be added to cover commission.